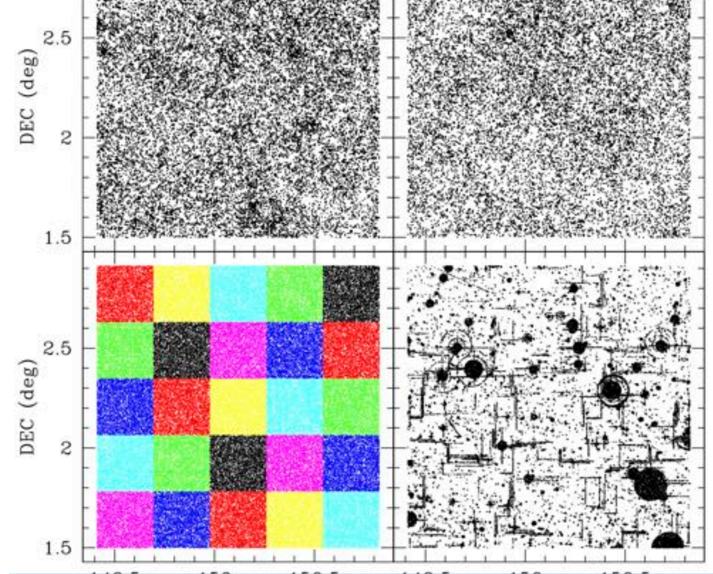

INTERGALACTIC EXTINCTION & MAGNIFICATION IN COSMOS WITH 30-BAND PHOTO-Z

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OVERVIEW

We define 2 galaxy samples (sources at $z \simeq 0.6$ and lenses at $z \simeq 1.0$) using a 99% C.L. photo-z selection based on estimates from individual COSMOS 30-band photo-z catalog. Source counts around lenses are used to normalize magnitude fluctuations in bands of different wavelengths. This allows to measure intergalactic extinction as a function of wavelength and radial separation from the lenses. We find extinction laws that are consistent with those in Galatic extinction models with $R(V) \simeq 3.3$ and a radial profile that is $\Delta\gamma \simeq -0.4$ steeper at the U-band than at the K-band (which is consistent with no extinction).

COSMOS CATALOG

We select galaxy samples within 99% C.L. photo-z bins in the COSMOS 30-bands (2-deg2) catalog [1]:

- Lenses: $20.0 < i_{AB} < 22.5$, 8447 galaxies with $0.4 < z < 0.8$
- Sources: $22.5 < i_{AB} < 25.0$, 17079 galaxies with $0.8 < z < 1.2$

We estimate background (Source) counts $<\delta_G>$ and magnitude fluctuations $<\Delta m>$, for different bands λ, averaged around all lenses as a function of the angular separation θ. In the absence of weak lensing and extinction, these correlations should be zero if these two photo-z bins are uncorrelated.

MAGNITUDES & COUNTS

Extinction and magnification δ_μ induce a signal [2]:

$$< \Delta m > \; = \; \alpha_m(\lambda)\, \theta^{\Delta\gamma(\lambda)} < \delta_\mu(\theta) >$$
$$< \delta_G > \; = \; \alpha_c(\lambda) \, < \delta_\mu(\theta) >$$

$$\alpha_m(\lambda) \equiv \alpha_m + r(\lambda) - (\frac{\ln 10}{2.5}\alpha_m + 1) r(\lambda*)$$
$$\alpha_c(\lambda_*) \equiv \alpha_c - \frac{\ln 10}{2.5}(\alpha_c + 1)\, r(\lambda*) \qquad (1)$$

where $A_m(\lambda) \equiv r(\lambda)\delta_\mu$ is the magnitude extinction, which depends on wavelenght λ, and α_m and α_c are the slopes of the mean magnitude and count distribution (in the absence of extinction) selected with $\lambda* = i_{AB}$.

NULL TESTS

Photo-z errors

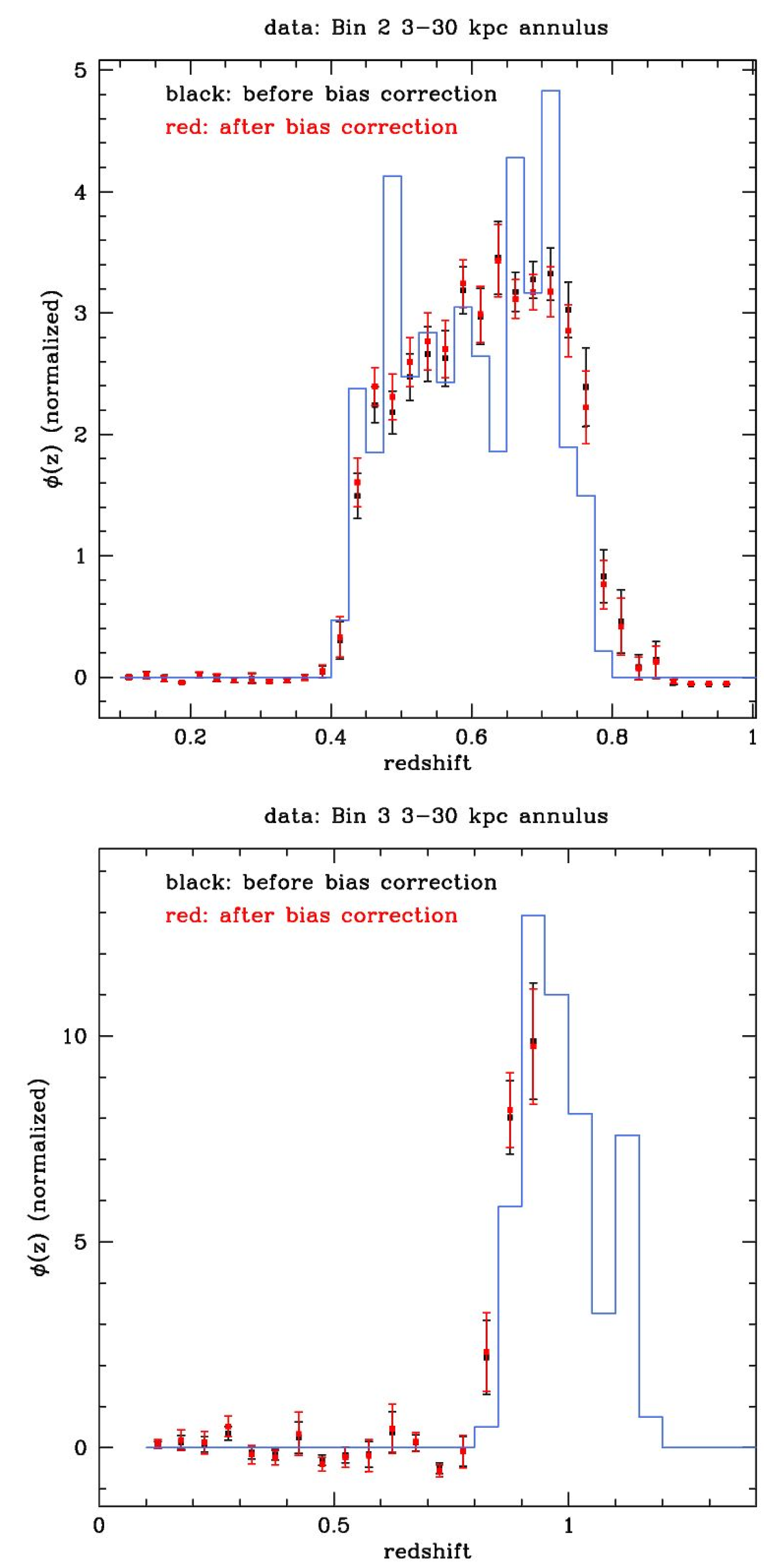

Fig. 1: Comparison of the stack photo-z PDF (histograms) with an estimate of $N(z)$ (points with errorbars) based on the cross-correlatation [3] of the lenses (top) and sources (bottom) with the overlaping spectroscopic galaxies.

Counts Magnification

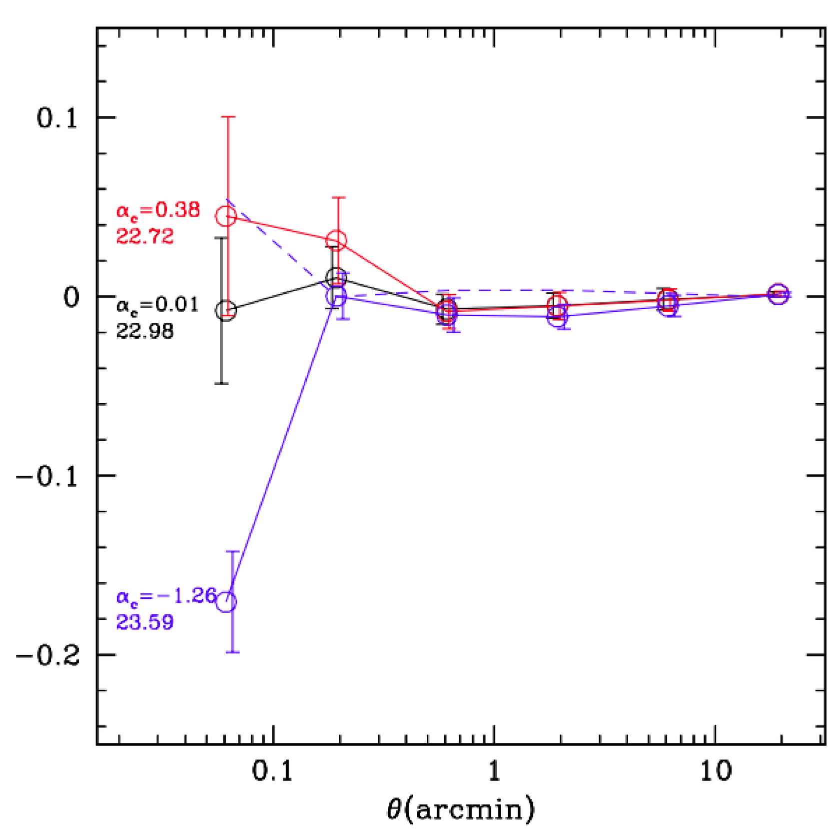

Fig. 2: Counts $<\delta_G>$ around Lenses for difference Sources selected in r-band 20<r<24 (red), i-band 22.5<i<25.0 (blue) and 20<r<24.4 (black), chosen to expand different number count slopes α_c. Dashed line shows scaling from the blue to the red using the relative slopes. Signal scales as predicted by magnification. Extinction corrections are a small contribution for counts, see Eq.(1).

RESULTS

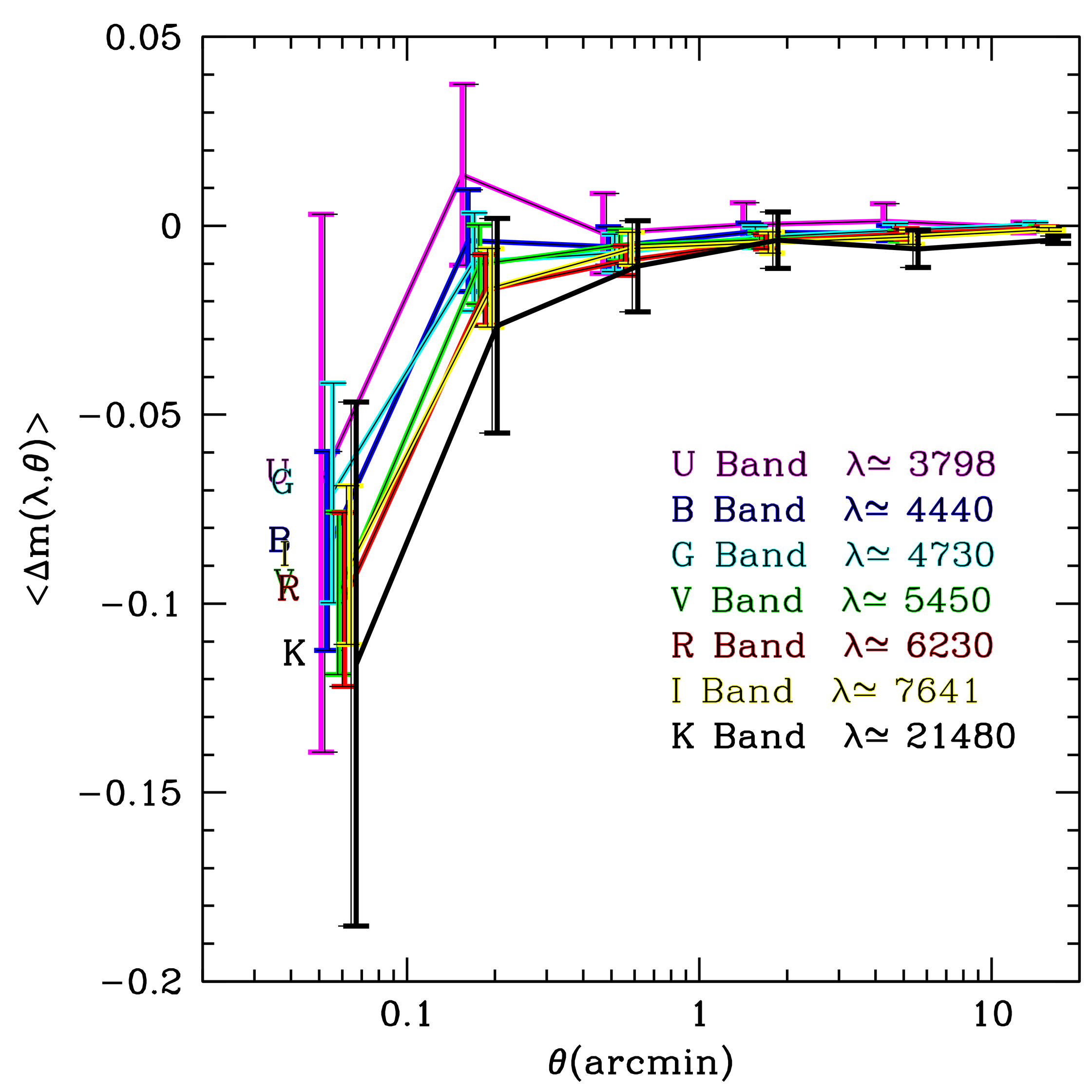

Fig. 3: Source magnitude fluctuations $< \Delta m >$ for different bands λ around lenses. The smallest scales $\theta < 0.1$ arcmin correspond to < 10kpc at $z \simeq 0.6$.

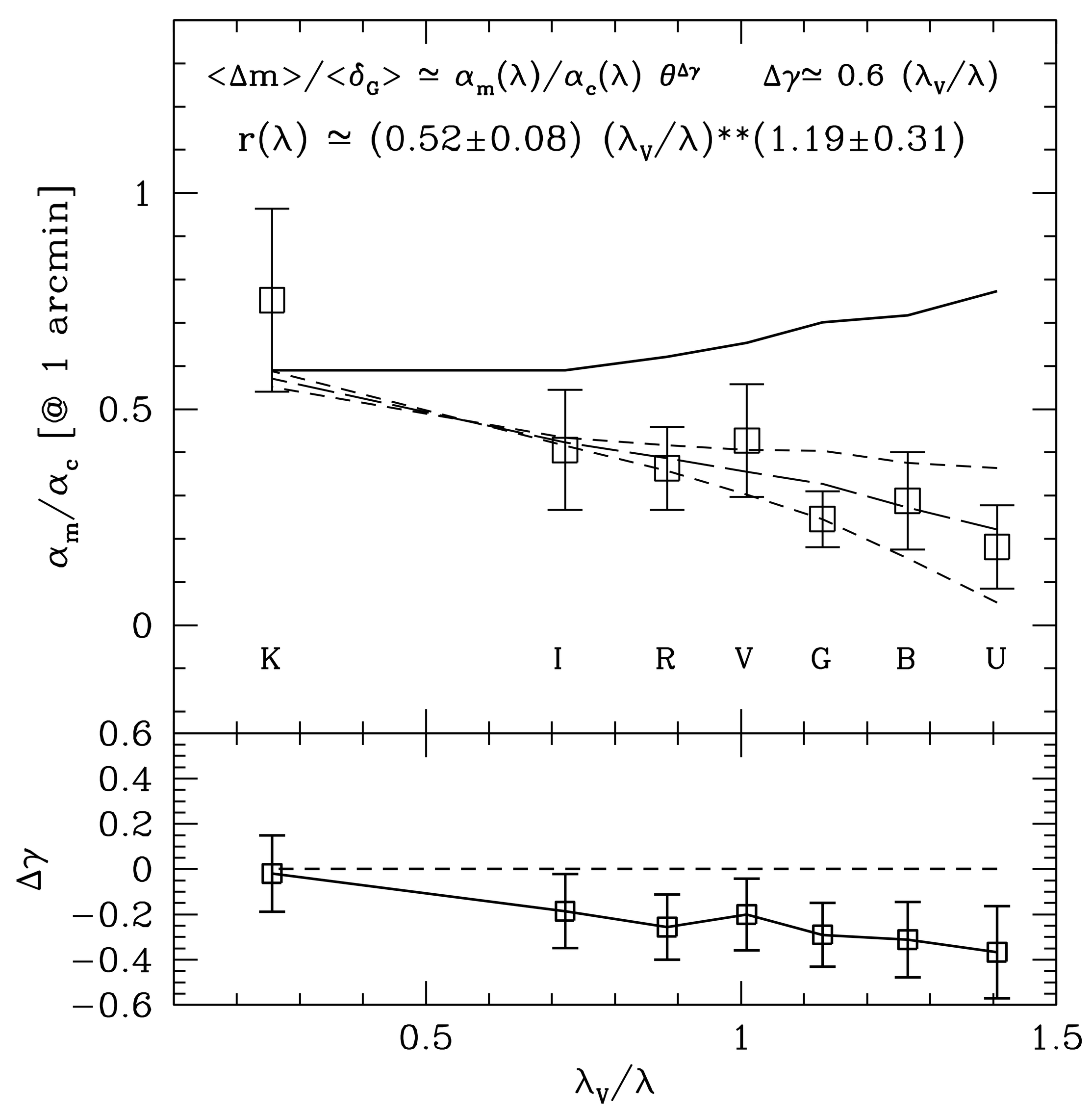

Fig. 4: Points show ratios $< \Delta m > / < \delta_G >$ at $\theta = 1$ arcmin. Continuous: α_m/α_c without extinction. Dashed lines: fit to extintion curve $r(\lambda)$. Bottom: $\Delta\gamma$

DISCUSSION

We test, using cross-correlations with spectroscopic data, on 3-30 Kpc scales, that our lense and source samples have negligible redshift overlap (Fig.1). Our photo-z selection produces very negative counts slopes ($\alpha_c < -1$) at $i_{AB} < 25$, consistent with the measured source count decrements around lenses. Buy using brighter and bluer samples we can select different slopes to validate the expected scaling of magnification with the counts slope. We show that the source galaxy counts around lenses are consistent with the weak lensing magnification signal and that the measurements scale with the number count slope as predicted (Fig.2). The slope of the counts is less sensitive to extinction than the one for magnitudes (see Eq.1).

The measured values of $r(\lambda) = 052 \pm 0.08 (\lambda_V/\lambda)^{1.19\pm0.31}$ in Fig.4 agree with Milky Way extinction laws with $R(V) = A(V)/[A(B) - A(V)] \simeq 3.3 \pm 0.5$. We find steeper radial profiles ($\Delta\gamma \simeq -0.4$) for the bluer bands than for the mass profiles traced by number count magnification over the same lense sample (bottom panel in Fig.4). This indicates that dust and gas is more concentrated the rest of the matter. Extinction in the V-Band contributes $52 \pm 8\%$ to the total absorption, the other 48% comes from magnification. On smaller scales or for bluer bands the contribution is even larger.

What combination of observables and cross-correlations will yield a clean magnification measurement given LSST photo-z quality? Is there an optimal kernel to weight counts and magnitudes together for LSST depth?

REFERENCES

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[3] S. Schmidt et al., 2013 , MNRAS, 431, 330